IMPROVING WRITING SKILLS THROUGH DIAGNOSING AND TREATING AT-RISK WRITERS

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ABSTRACT

In 2015, the U.S. Army Command and General Staff College (CGSC) developed the Pre-Command and General Staff Officers' Course (CGSOC) Writing Program (PCWP) to improve students' writing skills. This study examined how attending the PCWP affected students' subsequent academic performance. Using a causal-comparative research design, the authors analyzed the academic performance of 720 CGSOC students, including 39 that attended the PCWP. The analysis found that attending the PCWP increased student performance on written exams later in the course. Additionally, this study found that the diagnostic essay used to select students for the PCWP is a weaker predictor of academic risk than a writing skills test and the Nelson-Denny reading test. These findings support recommendations for further study in Army communication skills, faculty development in writing evaluation, and curriculum changes throughout Army University. These findings also would be generalizable to other institutions of higher learning as well as leaders in business and government who might be interested in refining writing education through improved writing skills diagnosis.

INTRODUCTION

Written communication is an essential skill for U.S. Army leaders (Dept of the Army, 2020, 2). High-quality writing allows leaders to communicate guidance without being physically present. Writing is especially important in environments where leaders may not always be physically present to clarify guidance and answer questions. In other words, effective writing enables effective command and control.

Despite the importance of writing, many Army leaders struggle to do it well. These struggles are evident at the U.S. Army Command and General Staff College (CGSC) where mid-career officers undergo a ten-month graduate-level course (The Command and General Staff Officer's Course, or CGSOC) for organizational leadership and service on a general staff. During the course, CGSOC students complete several written assessments. Although students receive six hours of writing skills instruction, many still perform poorly on written assessments and end up on academic probation. These Army leaders' weak writing skills not only put them at academic risk during the CGSOC, but more importantly, may have negative consequences for Army operations when the stakes are far higher.

To improve student writing, the CGSC faculty implemented the Pre-CGSOC Writing Program (PCWP) as an experiential learning approach. This program identifies weak writers and provides them with an intensive writing skills workshop before they begin the course. PCWP participants are identified through scoring of a diagnostic essay graded by faculty. The PCWP comprises 12 hours of writing skills instruction from experienced faculty members (See links to class slides below). The aim of the program is to improve students' academic performance in the CGSOC and reduce the incidence of students entering academic probation because of poor performance on written assessments. Up until this study, there had not been a formal process to evaluate PCWP outcomes.

This study examines the PCWP's effectiveness in achieving these goals. It finds that the PCWP improved students' academic performance. It also finds, however, that the method of selecting students for the PCWP—a diagnostic essay—is not a strong predictor of academic risk. Instead, a combination of writing and reading skills tests better predict at-risk students.

PROBLEM

The Army emphasizes the need to build cognitive skills required to write effectively, making writing an aspirational skill for Army leaders. However, due to competing Army requirements, leaders find difficulty in regularly improving and mastering their professional writing skills. This problem is exacerbated by the fact that many field grade officers attending CGSC have not written academic argumentative essays since their undergraduate programs, from which officers are often ten years removed. The diagnostic essay prompt was designed to elicit a student argumentative essay. Graduates from CGSC will lead military planning sessions and communicate orders through writing. Poor writing can create a destructive domino effect on subordinate units, resulting in cascading misinterpretations that lead to actions that fail to meet the commander's intent. Despite this operational imperative, deliberate officer writing assessments rarely occur outside of formal, professional military education, which only occurs at intermittent times in an officer's career. This fact makes those educational touchpoints, such as CGSC, critical in sharpening an officer's communicative precision.

PURPOSE

The purpose of this quantitative program evaluation was to find the degree to which at-risk writers attending the PCWP improve their writing. Diagnostic essay scores and post-PCWP written instrument grades were compared to measure student improvement. Additionally, PCWP attendees' written academic performance was compared to the rest of the student body to determine any differences between their performance and the performance of the rest of their colleagues. Determining the degree to which this writing improvement intervention is successful will be useful in further refining the PWCP and will thus improve field grade officer writing prior to CGSC graduation.

LITERATURE REVIEW

Studies on college-level developmental education show a positive relationship between student access to writing development programs and improved academic performance. A 2004 study of 1,269 community college students found that students who participated in a developmental writing course had a "statistically significant greater grade average than students who did not participate in the writing course (Crews et al., 2004). Ragland (1997) concluded in a three-year study of Central Missouri State University students that preparatory college writing courses positively affected student academic achievement, with the Attendance group of developmental students statistically outperforming their peers who were enrolled directly in their college writing courses. Research shows that the effectiveness of these writing development programs is contingent upon diagnostic assessments that have a valid cut-off score and align with writing course learning outcomes.

A Kent State University study (Pfrenger et al, 2017) examined developmental writers who were identified from a population of 1,301 students through standardized placement testing. After evaluating their required enrollment in developmental courses with writing center visits, the data showed statistically significant results. Researchers revealed a positive relationship between their mandatory and developmental education and increased passing rates. Kuiken and Vedder (2021) made similar conclusions, in which 75% of 1,017 studied students who failed their initial diagnostic writing attendance were able to pass after attending a compulsory remedial academic writing program. Both studies asserted the role of mandatory developmental education as critical in establishing positive results in students' academic performance. Relying solely on diagnostic assessments and optional or student-initiated remediation may not yield the same positive results (Southard et al., 2004).

Additionally, there is some evidence that intensive, short-duration interventions can improve academic skills. Kallison (2017), for example, found that short, intense academic interventions improved high school graduates' academic preparedness. Moreover, Miller et al. (2015) showed that an intensive writing intervention improved student nurses' writing skills and confidence. Together, these studies suggest that a short, intense intervention like the PCWP can result in improved skills and academic performance.

HYPOTHESES

The literature reviewed above suggests that attending the PCWP should improve CGSOC students' academic performance. Accordingly, we hypothesize that:

> Hypothesis 1 (H1). Attending PCWP will improve CGSOC students' written assessment scores.

> Hypothesis 2 (H2). Attending the PCWP will reduce the likelihood of CGSOC students failing a written assessment.

Research Design

To test the hypotheses, we analyzed a sample of recent CGOSC students. Using regression analysis, we examined whether students who attended the PCWP scored higher on written exams compared to students who did not attend. Regression analysis was appropriate because the CGSC selected students for PCWP based on their diagnostic essay scores. Consequently, PCWP students were not a random sample and were more likely to have weaker academic skills than other students. Regression modeling allowed us to control for academic skills differences between the two groups using pre-course reading and writing diagnostic assessments as control variables.

Data

Our sample consisted of 720 CGSOC students from academic year 2021 (AY21). Although 1048 students enrolled in the CGSOC course in AY21, we identified 720 complete cases (all the variables of interest were present). The missing cases were primarily a result of the COVID-19 pandemic. Roughly 25% of students attended the first half of the course remotely and could not take the Nelson-Denny test that we relied on for our analysis. The remainder of the incomplete cases were either international military students (omitted from this study because most speak English as a second language) or U.S. students that dropped out of the course.

We handled the missing data using complete case analysis (CCA)—dropping all incomplete cases. Although CCA is a common way of dealing with missing data, the pattern of missingness must be random for unbiased estimates (Rubin & Little, 2019, Schafer and Graham, 2002; White and Carlin, 2010; Hughes et al., 2019). We tested for random missingness using Little's (1998) Missing Completely at Random (MCAR) test. The null hypothesis of this test was that data were missing randomly (independent of the observed data). Our MCAR test statistic was not significant (n=1037, χ^2= 8.96, df=12, p=0.70), so we failed to reject the null hypothesis. Our data were MCAR. Therefore, we could treat the complete cases as a random subsample and proceed using CCA.

Dependent Variables

The Hypothesis 1 dependent variable was *Exam.* It was a continuous measure of students' written exam performance (M=90.99, SD=4.06), calculated by taking the mean of two written exams (leadership and history) that students wrote between 12 and 16 weeks into the course.

The Hypothesis 2 dependent variable was *Fail.* It was a dichotomous indicator of whether a student failed either the leadership or history exam (score < 80) coded 1=failed one or both exams, or 0=passed both exams. There were 58 failures among the 720 students.

Independent Variable

PCWP was our variable of interest. It was a dichotomous indicator for PCWP test coded 1=attended PCWP, or 0=did not attend. Of 720 students, 39 attended PCWP. We hypothesized that all else equal, attending the PCWP would improve students' written exam scores and make them less likely to fail a written exam.

Control Variables

We controlled for five variables that were deemed likely to influence the dependent variables. *Diagnostic* was students' score on a diagnostic essay administered before the course and graded by a CGSC faculty member. *LRC* was a dichotomous indicator for students who visited the CGSC Learning Resource Center (LRC) after the course began but before writing the first of the two exams that comprised the *Exam* and *Fail* dependent variables (1=visited LRC, 0=did not visit). *Skills* was students' score on a multiple-choice writing skills test (25 question, multiple choice on style and grammar) administered before the course. *ND Reading* was students' reading efficiency (a function of reading rate and comprehension) as measured by the Nelson-Denny reading test. *ND Vocabulary* was students' vocabulary score, also from the Nelson-Denny test. Table 1 (on the next page) shows the summary statistics for all variables.

Methods

We used regression analysis to test the hypotheses. For Hypothesis 1, we used ordinary least squares (OLS) regression since the dependent variable *Exam* was continuous. For Hypothesis 2, we used logistic regression since the dependent variable *Fail* was dichotomous. All models included Huber-White standard errors for robustness against heteroskedasticity.

TABLE 1. VARIABLE SUMMARY STATISTICS

	Variable	N	Mean	SD	Min	Max
Did not at-tend PCWP	Diagnostic	681	16.10	2.36	9.00	20.00
	LRC	681	0.04	0.20	0	1
	Skills	681	65.99	11.69	36.00	96.00
	ND Efficiency	681	254.81	90.27	40.00	610.00
	ND Vocabulary	681	71.47	6.57	35.00	80.00
	Exam	681	91.46	3.75	72.44	99.00
	Fail	681	0.03	0.18	0.00	1.00
Attended PCWP	Diagnostic	39	9.26	1.07	7.00	11.00
		39	0.15	0.37	0	1
	Skills	39	58.82	11.17	38.00	82.00
	ND Efficiency	39	219.83	107.00	52.11	546.18
	ND Vocabulary	39	67.64	8.23	43.00	79.00
	Exam	39	91.04	4.60	81.00	98.50
	Fail	39	0.03	0.16	0.00	1.00

RESULTS AND DISCUSSION

Hypothesis 1: Academic Performance

Our hypothesis that students who attend the PCWP would score higher on their written exams was supported. The regression results (Table 2 as follows) show that all else equal, students who attended the PCWP had a significantly ($p<0.05$) higher mean exam score (1.7 points) compared to students who did not attend. Although 1.7 points appears modest, it is a substantive effect. Although exam scores could technically range from 0 to 100, the actual scores range from 72 to 99 (Table 1 as follows). Thus, 1.7 points represented a 6% improvement within the range of the reported mean scores. Moreover, the two exams that comprised the mean exam score were weighted to measure students' knowledge and application of course content rather than on writing skills. Nevertheless, the PCWP was associated with a 6% performance improvement despite not covering any of that content. This result suggests that the PCWP had a substantial positive impact on students' academic performance.

Hypothesis 2: Written Exam Failure

The hypothesis that students who attended the PCWP will be less likely to fail a written exam was not supported because we lacked the data to test it. Of the 39 PCWP students analyzed, only one failed an exam. One failure is well below the number of events needed to make valid inferences from logistic regression (Bujang et al., 2018). Still, there were enough observations of other variables that the logistic regression showed which factors affect exam failure. The results are shown in Table 3 below. The only statistically significant predictor was the writing skills test score ($p<0.01$). That is, students with higher scores were less likely to fail a written exam.

ASSESSING ACADEMIC RISK

While the above results tell us that PCWP helped students, an important question that emerged was whether the method employed by CGSC leadership to identify students who needed help was actually working. The CGSC relied on the diagnostic essay to recommend students for PCWP, but was the essay the best predictor of academic risk?

To answer this question, we examined which of the four pre-course assessments—the diagnostic essay, writing skills test, Nelson-Denny vocabulary, and Nelson-Denny reading efficiency—were strong predictors of academic success. We first measured the correlation between these assessments. The results in Table 4 below show that while none of the four predictors strongly correlated with exam scores, the writing skills test was the strongest (0.34), followed by the Nelson-Denny vocabulary (0.28) and efficiency (0.26) scores. The diagnostic essay (0.17) was the weakest indicator of academic risk of all four pre-course assessments.

TABLE 2. PREDICTORS OF MEAN EXAM SCORE

Variables	(1) Complete Case
Attended PCWP	1.725**
	(0.816)
Diagnostic Essay Score	0.174***
	(0.059)
Writing Skills test Score	0.079***
	(0.012)
ND Vocabulary	0.076***
	(0.027)
ND Reading Efficiency	0.004***
	(0.002)
Visited Learning Resource Center	0.401
	(0.756)
Constant	76.958***
	(1.872)
Observations	720
R-squared	0.165

Note: OLS regression coefficients with robust standard errors in parentheses and two-tailed tests significant at *** p<0.01, ** p<0.05, * p<0.1.

Next, we investigated the effect size of each pre-course assessment on mean exam scores as estimated in the Hypothesis 1 analysis. Table 5 below shows the standardized coefficients alongside the relevant results from Hypothesis 1. Once again, the writing skills test was the strongest predictor with the largest effect size (0.243) with the remaining three pre-course assessments having about half the effect size of the writing skills test.

These results suggest that using the pre-course assessments in combination would give a better estimate of student risk than the diagnostic essay alone. To test this idea, we compared two composite risk measures against the diagnostic essay and the writing skills test. To make the predictors comparable, we converted the four predictors into z-scores. Our first two risk estimators are the diagnostic essay and writing skills z-scores by themselves. Our second two risk estimators were composite measures of multiple variables. *Risk3* averaged the z-scores for the writing skills test and both Nelson-Denny tests, while *Risk4* added the diagnostic essay z-score to the average. The research goal was to compare composite estimators with and without the diagnostic essay because it required the most time to administer and grade. Researchers wanted to see if CGSC leadership could omit the diagnostic essay score and still get a reasonably good risk estimate. Finally, researchers inverted the four variables so that higher scores indicated higher risk. The summary statistics for the risk estimators are shown in Table 6 below.

To compare our risk measures, we regressed *Exam* on each of our risk indicators controlling for PCWP and LRC attendance. The risk estimator coefficients are shown in Figure 1 below. Unsurprisingly, the composite risk estimators outperform the diagnostic essay and writing skills test. And while *Risk4* had a statistically stronger effect size than *Risk3* (χ^2= 34.91, df=1, p<0.001)*,* the substantive difference was modest. These results suggest that *Risk3* performs nearly as well as *Risk4* in assessing student risk without relying on the diagnostic writing essay and the associated faculty hours required to administer and grade it.

TABLE 3. PREDICTORS OF EXAM FAILURE

| VARIABLES	(1) Complete Cases
Attended PCWP	-1.585
	(1.080)
ND Reading Efficiency	-0.003
	(0.004)
Diagnostic Essay Score	-0.102
	(0.092)
Writing Skills test Score	-0.050***
	(0.015)
ND Vocabulary	-0.022
	(0.031)
Visited Learning Resource Center	0.701
	(0.754)
Constant	3.461*
	(1.777)
Observations	720

Note: Logistic regression coefficients with robust standard errors in parentheses and two-tailed tests significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

TABLE 4. CORRELATIONS BETWEEN PREDICTOR VARIABLES AND EXAM SCORES

	Diagnostic	Skills	ND Vocabulary	ND Efficiency	Exam
Diagnostic	1.00				
Skills	0.25***	1.00			
ND Vocabulary	0.22 ***	0.33 ***	1.00		
ND Efficiency	0.16 ***	0.33 ***	0.51 ***	1.00	
Exam	0.17 ***	0.34 ***	0.28 ***	0.26 ***	1.00

Correlations significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 2 on the next page shows how *Risk3* compared to the diagnostic essay as a predictor of low test scores. The dashed line in each scatter plot shows the predicted values. It is visually apparent that *Risk3* is better at predicting low test scores. The line slope is steeper and most of the failing test scores (<80) are associated with higher risk scores. The red dots in each plot show the PCWP students. The top plot confirms that students with low diagnostic essay scores attended PCWP. However, the second plot suggests that not all these students would be identified as high-risk using the three-variable measure.

Limitations

Before discussing our conclusions, we note several important limitations of this study. First, our PCWP student sample was small (n=39), which limited the statistical power for additional analyses. It is plausible, for example, that PCWP benefited high-risk students more than low-risk students, but we did not have a large enough sample to test this question.

TABLE 5. PRE-COURSE PREDICTORS OF MEAN EXAM SCORE WITH STANDARDIZED COEFFICIENTS

VARIABLES	(1) Coefficient	(2) Standardized Coefficient
Diagnostic Essay Score	0.174***	0.127
Writing Skills test Score	0.079***	0.243
ND Vocabulary	0.076***	0.134
ND Reading Efficiency	0.004***	0.104

Note: OLS regression coefficients with robust standard errors in parentheses and two-tailed tests significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$. See Table 2 for the full regression model

TABLE 6. SUMMARY STATISTICS FOR STUDENT ACADEMIC RISK MEASURES

| Variable	Obs	Mean	Std. dev.	Min	Max
Diagnostic z-score	720	0.00	1.00	-1.54	3.14
Skills z-score	720	0.00	1.00	-2.58	2.52
Risk3	720	0.00	0.77	-2.33	3.08
Risk4	720	0.00	0.69	-2.13	2.41

Note: For the Risk3 and Risk4 variables, we averaged the z-scores that comprise each measure but did not re-standardize the result. Consequently, the standard deviations are not equal to 1.00.

FIGURE 1. RISK ESTIMATOR EFFECTS ON MEAN EXAM SCORES
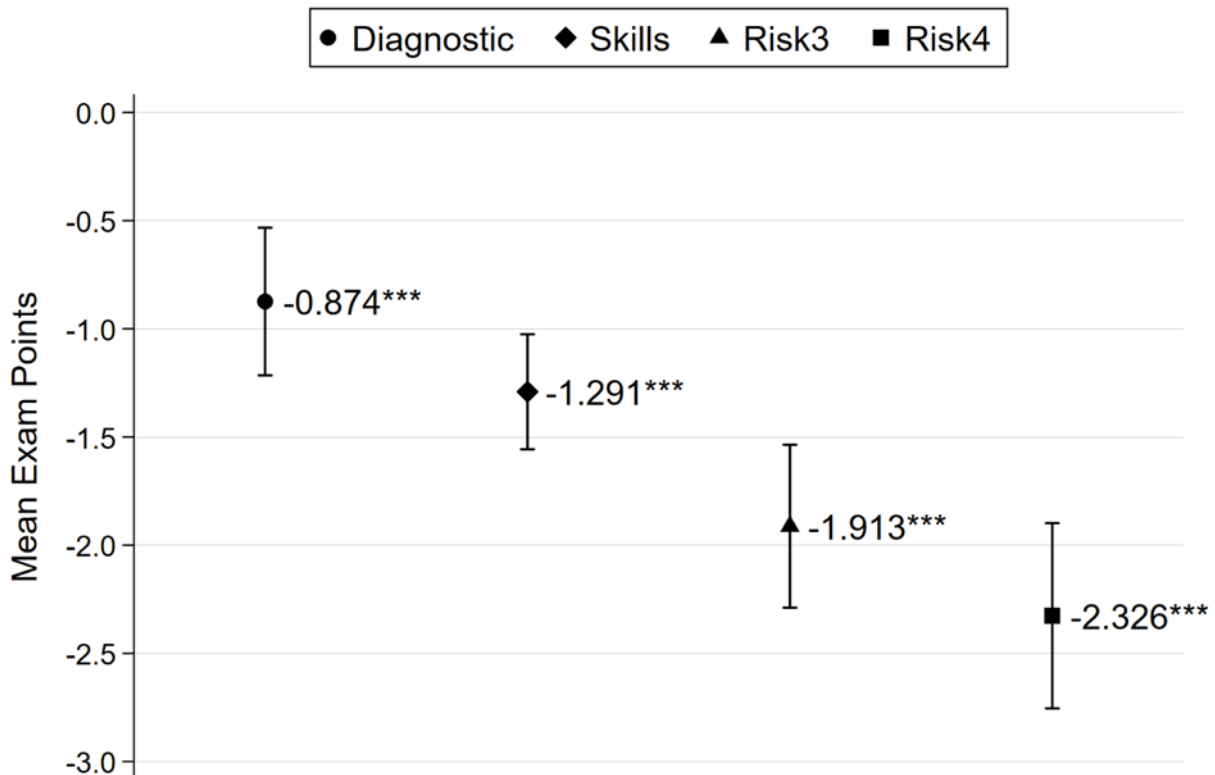
Note: OLS regression coefficients with 95% confidence intervals. Two-tailed tests significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$. See Table A1 for full regression tables.

FIGURE 2. COMPARISON OF DIAGNOSTIC ESSAY
AND THREE-VARIABLE COMPOSITE RISK PREDICTOR.
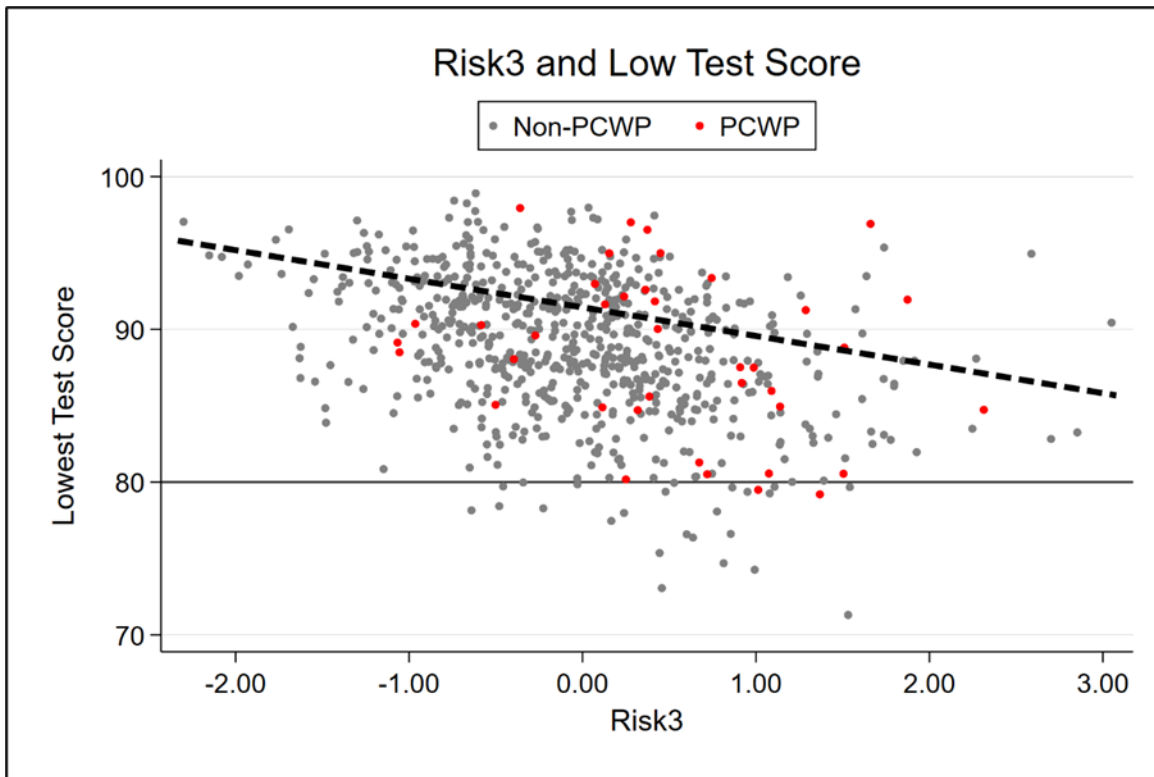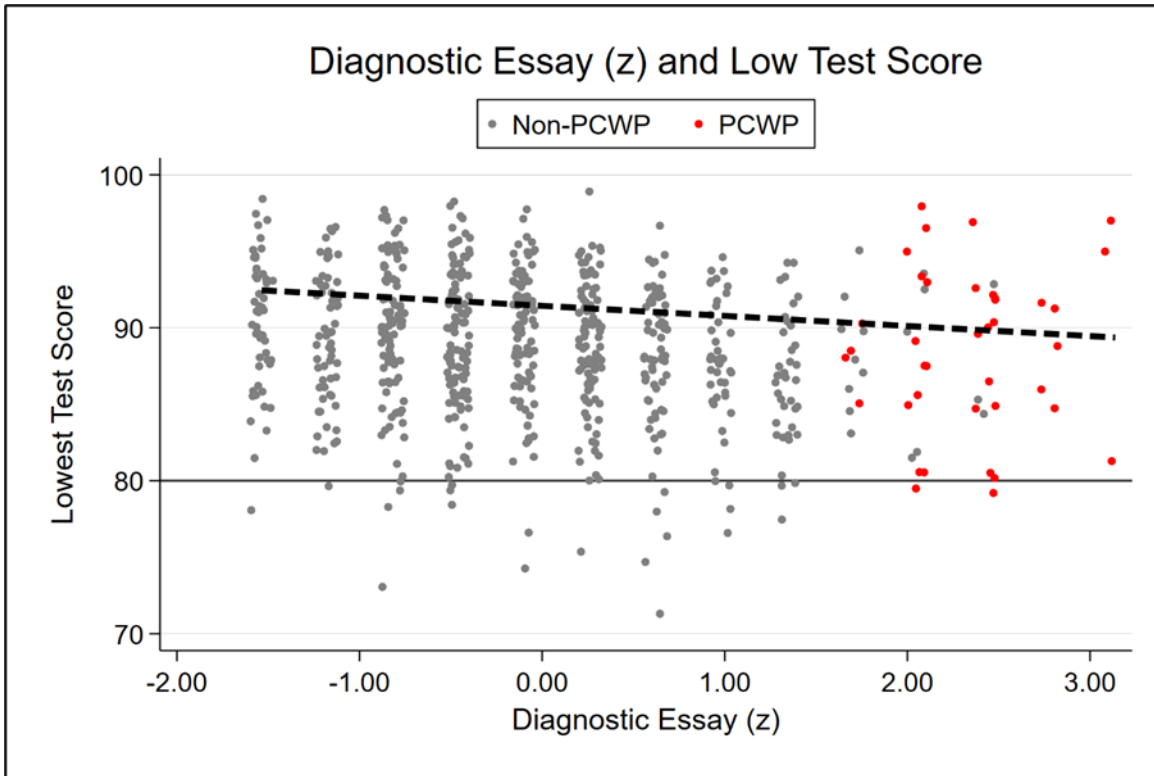
Second, we did not have data on inter-grader reliability for the diagnostic essay scoring. One faculty member graded each essay. Although many graders attended a class to standardize grading, we do not know how well this translated to reliable grades. Measuring and improving inter-grader reliability might have increased the diagnostic essay's predictive power but at the cost of faculty time and resources.

A third limitation is that there were few exam failures (n=24) in our sample. Thus, we were not able to assess whether the PCWP reduced the likelihood of students failing an exam. However, since the PCWP improved exam scores, Hypothesis 2 seemed plausible. Future research should revisit Hypothesis 2 using a larger sample.

Fourth, our data did not account for two variables: students' education level and teaching team writing improvement programs. Some CGSC students had civilian graduate degrees, but we did not have these data. Also, some teaching teams offered writing improvement programs. However, these were informal seminars, and the school does not keep records of who attends. As a result of these missing data, our results may have suffered from omitted variable bias.

Finally, this study had limited generalizability to graduate students. The CGSC students in this study were adult learners with eight to ten years of professional experience. Our results likely generalized to other adult learners but may not generalize as well to graduate students coming straight from undergraduate study.

These identified limitations could be addressed in future research by improving data management procedures at CGSC (see discussion of student identification numbers below) and by increasing the size of the sample. Future research efforts are planned at CGSC to improve the rigor of the data and thus the conclusions derived from that data.

CONCLUSIONS AND RECOMMENDATIONS

PCWP

The PCWP is helping at-risk writers as indicated by statistically significant increases in student scores as compared to peers. The method of determining at-risk students due to writing skills deficiencies was assessed to be less effective than combinations of assessment instrument scores already in use at CGSC (see below conclusion and recommendation under diagnostic essay).

Diagnostic Essay

The findings of this study suggest that the diagnostic essay, although a useful writing feedback tool for faculty, is not a statistically reliable tool for determining student academic risk due to writing skills deficiencies. A combination of the Nelson-Denny with the Writing Skills exam was assessed to be a more powerful predictor of who is at risk for writing challenges. Recommend discontinuing faculty scoring of the diagnostic essay but continue using it as a feedback tool for teaching team faculty feedback. Replace the diagnostic essay scoring with combinations of Nelson-Denny and Writing Skills exam. Additionally, an Asset test (series of five paragraph sets that students place in the correct order) could be added to the pre-CGSC assessment process and combined with the Nelson-Denny and the Writing Skills exam, could be a more powerful predictor of at-risk students due to writing skills deficiencies.

LRC Attendance

Researchers assessed that LRC attendance to be helpful for students who are struggling with writing deficiencies. Researchers need more data to assess the level to which LRC attendance is helpful. Researchers discovered that instituting some data hygiene measures could facilitate future research efforts.

Student Identification Numbers

Most colleges use student identification numbers to facilitate data collection efforts for research. A discussion with the West Point registrar revealed that they use student identification numbers for research purposes and made several recommendations. Future discussions with the West Point registrar are planned. Recommend the institution of student identification numbers through the registrar to facilitate better student data management for future research efforts. Student identification numbers could aid not only with studying the effects of LRC attendance but with other research efforts as well.

CONCLUSION

The inspiration for this study was to determine if the PCWP was helping CGSC students achieve academic excellence through improved writing. The PCWP has been proven to help students. However, like most research projects, researchers discovered much more from the research journey than what served as the initial inspiration. For example, most faculty innately know that the Nelson-Denny score is an indicator of a student who may struggle academically. Research in this study has proved the strength of the Nelson-Denny as a predictor of academic risk. The application of the above recommendations based upon evidence can have the effect of improving the process of not only selecting the right students for writing help but could improve research CGSC-wide. This effort is an example of the application of the principles of outcome-based education and should be

sustained and encouraged. As many academic institutions are experiencing at risk writers in their student populations, a similar outcomes-based approach to writing improvement may be useful in contexts beyond CGSC.

End Notes

1. Nelson-Denny Practice and Test Prep – Complete Test Preparation Inc. (test-preparation.ca)

2. https://cgsc.blackboard.com/bbcswebdav/xid-26469887_1
   https://cgsc.blackboard.com/bbcswebdav/xid-26469889_1
   https://cgsc.blackboard.com/bbcswebdav/xid-26469892_1
   https://cgsc.blackboard.com/bbcswebdav/xid-26469895_1

3. A residuals plot of our initial ordinary least squares model (H1) suggested heteroskedasticity which we then confirmed with a Breusch-Pagan test (Chi2 = 21.43, p<0.01). We corrected for this problem by using robust (Huber-White) standard errors in the models reported in the results.

4. Notably, 20 PCWP students were not included in the analysis due to missing data. When considering all cases, PCWP students accounted for only 4 of 59 total exam failures.

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APPENDIX

TABLE A1. COMPARISON OF ACADEMIC RISK MEASURES.

VARIABLES	(1) Diagnostic (z)	(2) Skills (z)	(3) Risk3	(4) Risk4
Diagnostic Essay	-0.874***			
	(0.174)			
Writing Skills		-1.291***		
		(0.135)		
Risk3			-1.913***	
			(0.192)	
Risk4				-2.326***
				(0.218)
Attended PCWP	1.797**	0.363	0.532	1.876**
	(0.842)	(0.695)	(0.730)	(0.759)
Visited Learning Resource Center	-0.604	0.015	0.365	0.357
	(0.773)	(0.782)	(0.746)	(0.749)
Constant	91.370***	91.419***	91.394***	91.321***
	(0.147)	(0.140)	(0.138)	(0.139)
Observations	720	720	720	720
R-squared	0.039	0.114	0.146	0.157

Note: OLS regression coefficients with robust standard errors in parentheses and two-tailed tests significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

TABLE A2. PREDICTORS OF SELECTION FOR PCWP

VARIABLES	(1) Without Diagnostic Essay	(2) With Diagnostic Essay
Diagnostic Essay Score		-2.158***
		(0.351)
Writing Skills Test Score	-0.046**	0.037
	(0.018)	(0.030)
ND Vocabulary	-0.038	0.002
	(0.026)	(0.055)
ND Reading Efficiency	-0.001	0.001
	(0.003)	(0.005)
Constant	2.819*	19.601***
	(1.637)	(4.396)
Observations	720	720

Note: Logistic regression coefficients with robust standard errors in parentheses and two-tailed tests significant at *** $p<0.01$, ** $p<0.05$, * $p<0.1$.